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RFID Based Automatic Toll-tax Collection System

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Abstract—This paper describes the RFID based automatic toll-tax collection system for toll gate. Most of the toll collection systems commonly used in India is manual transaction. Now a days, streams of traffic are increased and toll gate on highways are congested. It will cause the traffic jam and waste time. The objective of this project is to transform manual transaction to automated toll collection with the help of RFID technology. There are three portions in toll collection system. They are RFID system, balance deduction system in host computer and toll gate control system. For the RFID system, 13.56 MHz passive RFID reader and tag pairs are used. The balance deduction system is implemented by Microsoft Visual Studio and C# language is used to implement this system. The AVR microcontroller is also used to control the dc motor and display the deposit on the LCD. AVR microcontroller can check the ID numbers, vehicle numbers and the amount of balance with the database on PC. The new user can register and update the amount of balance via Graphical User Interface (GUI) easily. The amount of deposits will also update simultaneously at the two database of the toll gate because of XBee network. By using this system, it will save time, i.e. by avoiding long queue as no need to stop the vehicle and no need of manual transaction at the toll gate.

Index Terms- RFID, Microsoft Visual Studio, Dc Motor, Database

I. INTRODUCTION

Nowadays, increasing traffic volume causes congestions commonly around the toll gate of highway. Therefore, the new technique is urgently required to reform the problem of congestions. RFID Based Automatic toll –tax collection system is one of the methods to solve the above conditions. The automated system is composed of several subsystems. The RFID technology, computer database, power supply,AVR microcontroller, motor and inferred device are included. Automated system can bring the several sectors for toll gates as saving time and reducing the human workers. Develop the prototype model, which reproduces the operation states of various toll gate systems: passing time and waiting time. The RFID tag and RFID reader are contained in RFID technology. RFID means Radio Frequency Identification that consists of the tags which can be either active or passive tag. Passive tag do not have own power supply, much cheaper to manufacture and small coil antenna is used. On the other hand, active tag must have own power supply. It has longer range and larger memories. It can store additional information sent the RFID reader.RFID reader is an interrogator. It is placed at the toll gate on every single row where vehicles are passed. The reader contains an RF module, which acts as both transmitter and receiver of radio frequency signals. The reader generates the signal to receive the data from tag. The received signals send to the computer system which contains Graphical User Interface (GUI) and the database of all users. The ID number from the tag checks with the recorded database and deduces the toll tax. The computer and microcontroller are connected with USB cable. So, the AVR microcontroller is very compatible for system. The AVR microcontroller will display the amount of deposits on LCD and the gate will open. The IR sensor senses the vehicle motion for closing gate automatically.

II. BASIC CONCEPT

This system allows the vehicle drivers to pass the toll tax booths without stopping at the toll booths. The toll amount is deducted from the RFID card. This RFID card is rechargeable and account is stored on the records.This system will have two benefits. First benefit is that movement of traffic will be much faster as user will not wait to give the money because, driver has to just show the RFID card in-front of the card reader.Second benefit is that driver doesn't have to carry the money each time. He will just recharge the RFID card by certain amount and will use this card each time he travels. This is little bit similar to using credit cards. Most of the toll collection systems commonly used in India is manual transaction. Nowadays, streams of traffic are increased and toll gate on highways are congested. It will cause the traffic jam and waste time. The objective of this projects is to transform manual transaction to automated toll collection with the help of RFID technology

A. Applications

1) Faster toll collection system
2) Less manpower needed

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3) Fuel saving
4) Low cost and easy to implement
5) Financial leakage control
6) Vehicle tracking
7) Pay parking system



Figure .General RFID based toll tax image

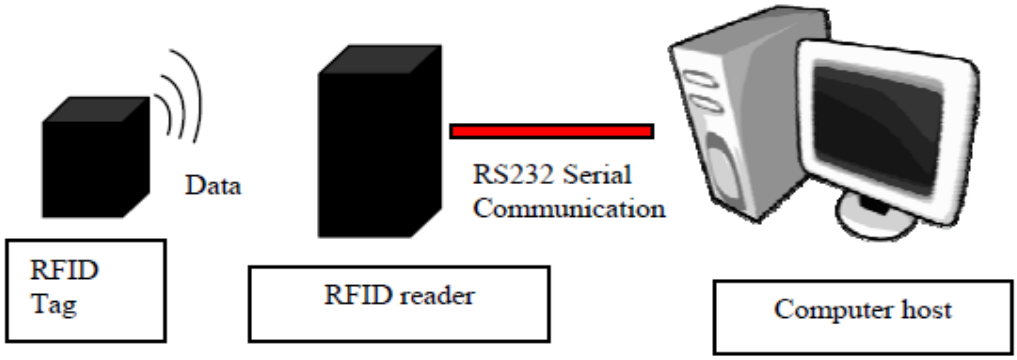


Figure: Complete RFID System

III. SYSTEM BLOCK DIAGRAM

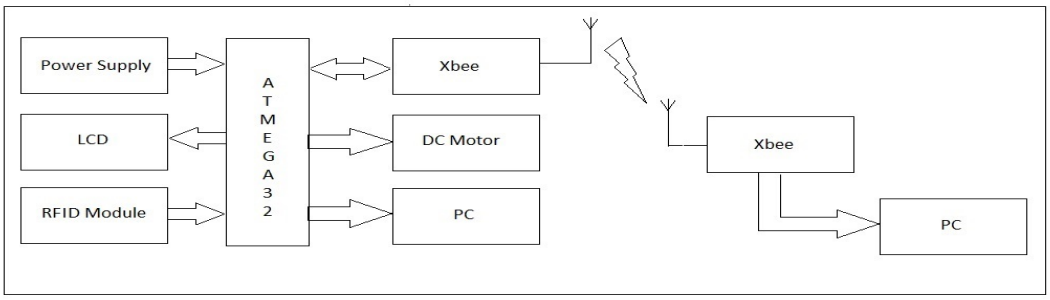


Fig:Block Diagram of RFID Based Automatic Toll-Tax Collection System

A. Block Description

1) *Liquid Crystal Display (LCD):* This module used for display the present status of the system. This is interface to 4 bit mode with LM016Lmicrocontroller LCD screen consists of two lines with sixteen characters each.
2) *Power Supply Unit:* The DC power supply unit is vital component in modern electronic devices as they need a wide range

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of DC voltages for their operations. The purpose of a power supply is to provide the required amount of power specified voltage from primary source.

3) *ATmega32:* ATmega32 is very much similar to ATmega16 microcontroller with certain differences which are discussed below. ATmega32 is an 8-bit high performance microcontroller of Atmel's Mega AVR family. Atmega32 is based on enhanced RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega32 can work on a maximum frequency of 16MHz.
4) *DC Motor:* A DC motor in simple words is a device that converts direct current(electrical energy) into mechanical energy.
5) *Xbee:* The XBee and RF Modules were engineered to meet IEEE 802.15.4 standards and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between devices. The modules operate within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each other.
6) *PC:* AVR Microcontroller can register and update the amount of balance via Graphical User Interface (GUI) easily. The amount of deposits will also update simultaneously at the two database of the toll gate because of LAN network.
7) *RFID Module:* The RFID tag and RFID reader are contained in RFID technology. RFID means Radio Frequency Identification that consists of the tags which can be either active or passive tag. Passive tag do not have own power supply, much cheaper to manufacture and small coil antenna is used.
8) *Max 232x:* The MAX232 device is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs.

B. Results

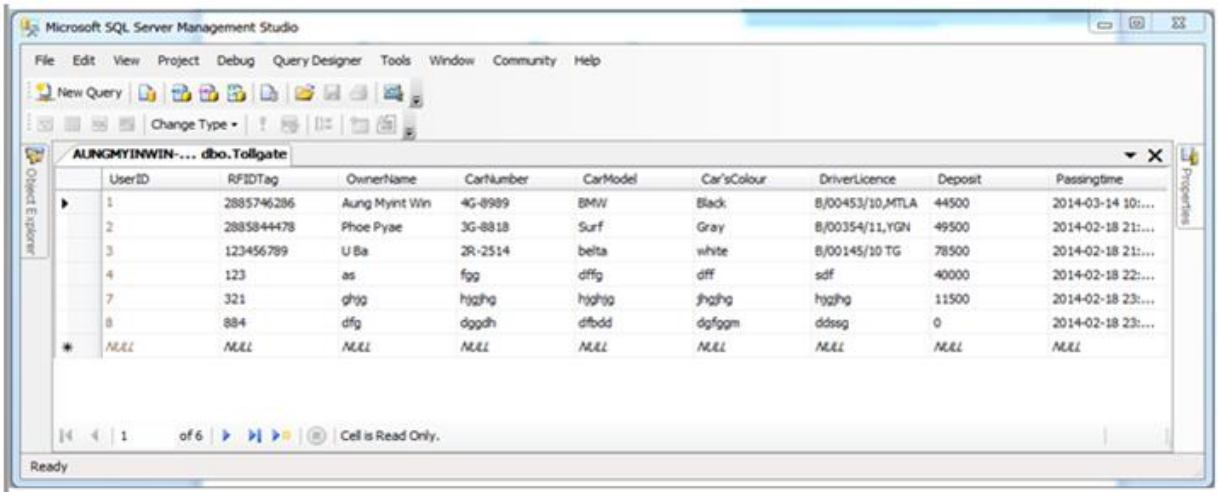
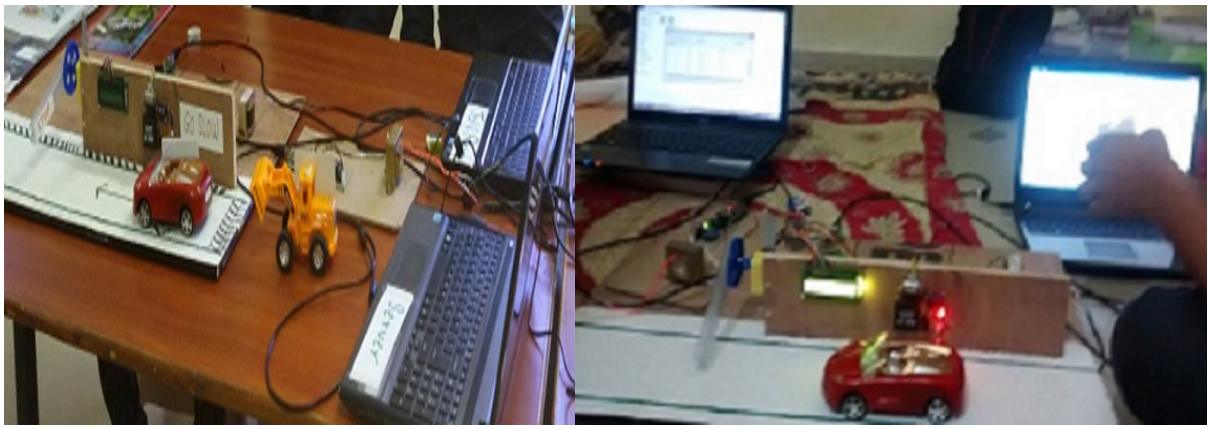
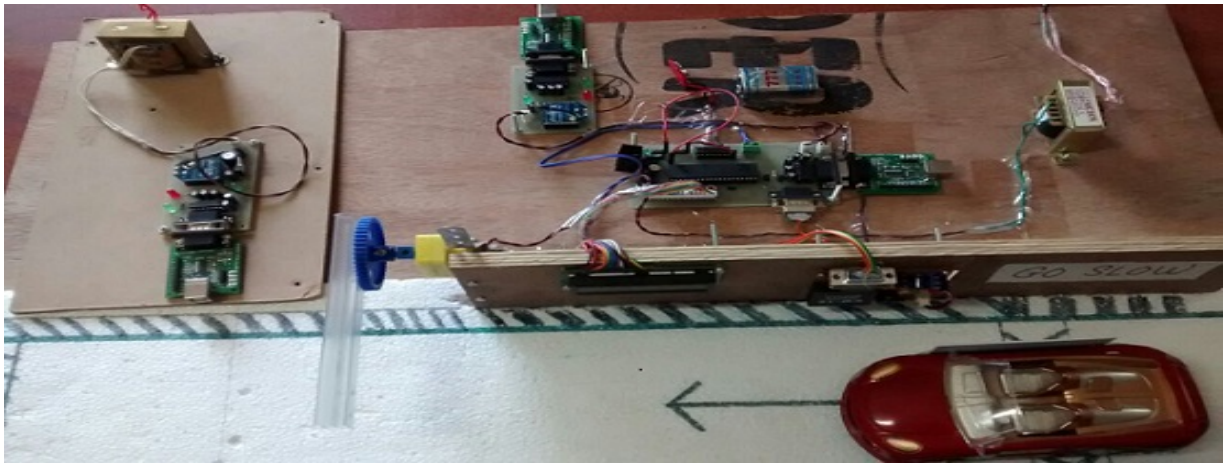


Figure: Recorded database in SQL Server

C. Hardware Results



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IV. CONCLUSION

By doing automation of toll plaza we can have the best solution over money loss at toll plaza by reducing the man power required for collection of money and also can reduce the traffic indirectly resulting in reduction of time at toll plaza.

This system mainly reviewed the research and development work for toll collection at the toll gate on highway with the help of passive RFID technology. By developing this system, the knowledge of RFID system,AVR microcontroller, the database construction, GUI design and USB connection between PC and PIC using c# language are realized. For this system, passive tags are better than the active tags because of low cost, low power consumption and also radio signals environmental factors. By using RFID based automated toll collection system, the vehicle can check for security with the passing time, save the time for toll collection and reduce traffic congestion at the toll plaza. Therefore, the RFID based Automatic toll-tax collection system is the best way for toll collection at the toll plaza.

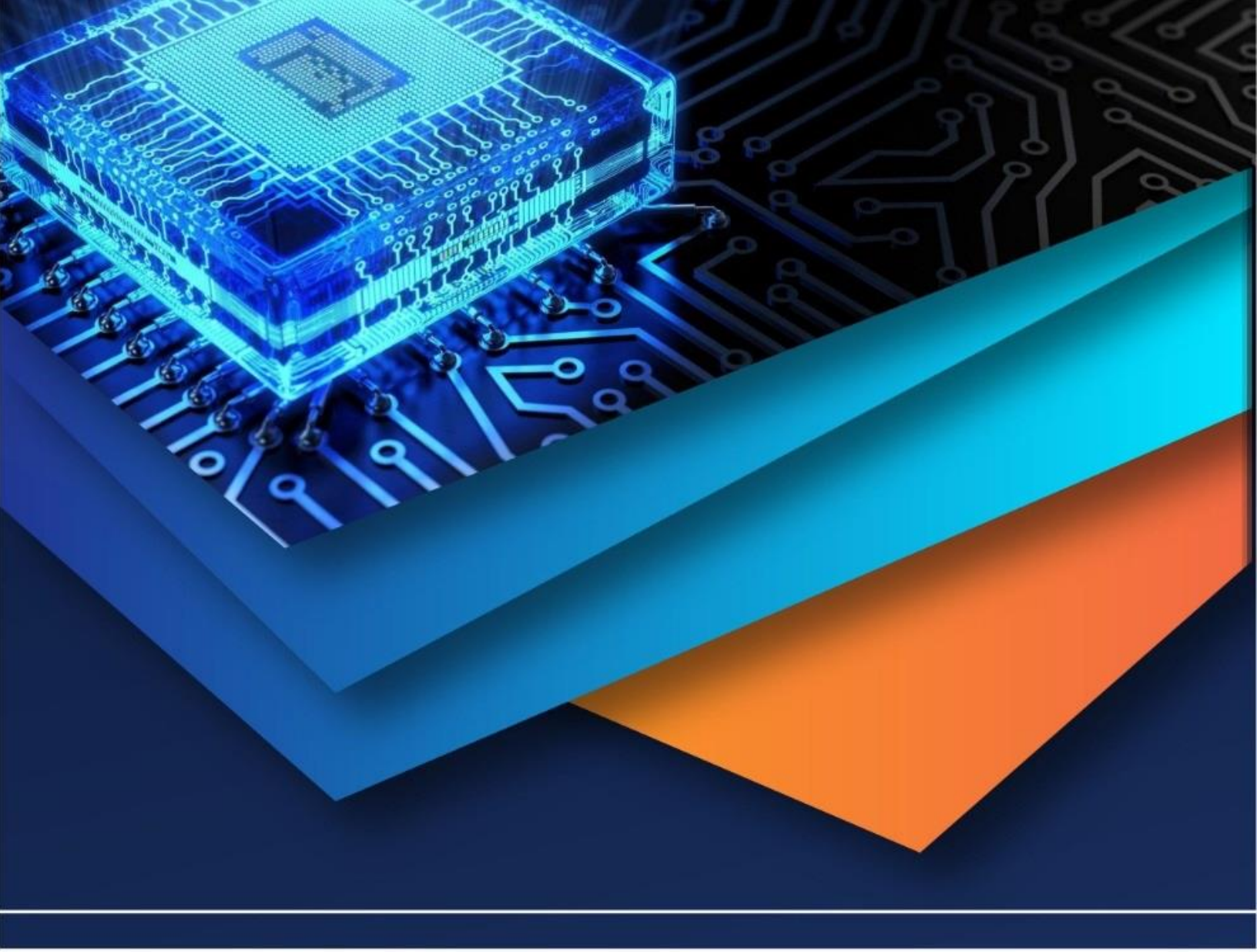
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